# PATENT ABSTRACTS OF JAPAN

(11)Publication number : 10-078317
(43)Date of publication of application : 24.03.1998

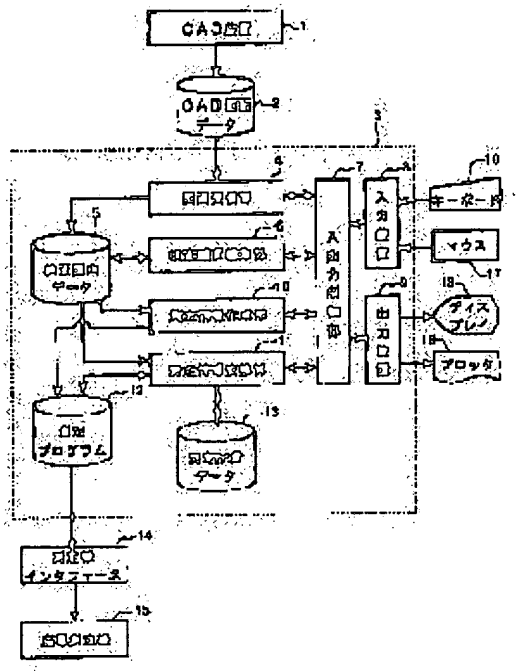
(51)Int.Cl. G01B 21/20
G06F 9/06
// G06F 17/50

(21)Application number : 08-234170
(22)Date of filing : 04.09.1996

(71)Applicant : NIKON CORP
(72)Inventor : ITO IZUMI
ISHIKAWA FUMIO

## (54) MEASUREMENT PROGRAM PREPARATION DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To make an inspection work efficient by installing a means for preparing inspection drawing data with three-dimensional information added to the design drawing data of a measurement object, a means for preparing a measurement program by use of the inspection drawing data, or the like.
SOLUTION: A drawing receiving part 4 receives CAD drawing data 2 including the shape of a measurement object from a CAD device 1 used to design the measurement object, and adds three-dimensional information thereto for the conversion of the data 2 into inspection drawing data 5. An inspection drawing editing part 6 (i.e., data preparation means) applies a drawing correction, three-dimensional information or the like to the inspection drawing data 5 for the re-edition thereof. Also, an input/output control part sends an instruction inputted to an input device 8 from a worker, to the inspection drawing editing part 6, a measurement information preparation part 10 and a measurement information conversion part 11. The measurement information preparation part 10 (i.e., program preparation means) receives an instruction regarding procedures related to the shape measurement of the measurement object from the worker and, then, prepares a measurement program 12 including measurement rout data to show measurement procedures.



LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision

* NOTICES *



---

CLAIMS

---

[Claim(s)]
[Claim 1] Measurement programming equipment which it had in a means to create the new measurement program collectively measured from the measurement arrangement data of each measurement program containing each measurement path data of a means to generate each measurement arrangement data showing each order of measurement and arrangement of two or more device-under-test articles, and two or more aforementioned device-under-test articles, and each above.
[Claim 2] Measurement programming equipment characterized by providing the following A means to read each engineering-drawing side data including two or more each configuration information or size information on a device-under-test article A means to create each drawing-for-inspection side data which added three-dimensions information to the engineering-drawing side data of each above A means to create each measurement program containing the measurement path data of two or more aforementioned device-under-test articles using the drawing-for-inspection side data of each above A means to create the new measurement program collectively measured from the measurement arrangement data of a means to generate each measurement arrangement data showing the order of measurement of two or more aforementioned device-under-test articles, and arrangement using the drawing-for-inspection side data of the measurement program of each above, and each above, the measurement program of each above, and each above
[Claim 3] Measurement programming equipment which combines the measurement program of each above and is characterized by creating a new measurement program in a claim 2.
[Claim 4] a claim 2 -- setting -- the above -- the measurement programming equipment characterized by performing creation of a new measurement program in the state of a measurement machine and off-line

---

[Translation done.]

* NOTICES *



---

DETAILED DESCRIPTION

---

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] this invention relates to the measurement programming equipment which creates the measurement program for measuring the configuration of a device-under-test article.
[0002]
[Description of the Prior Art] Conventionally, the following work is done in measurement of a machine part etc.
1. Install a device-under-test article in a measurement on a plane.
2. An operator operates a measurement machine, teaches a measurement procedure, and creates a measurement program.
3. Perform real measurement according to the created measurement program.
[0003] Moreover, recently, the simulation of measurement instruction is performed on a screen as deformation of 2 using the CAD drawing data of a device-under-test article, and the off-line teaching equipment of creating a measurement program is also realized. Moreover, in the inspection site, in order to inspect much device-under-test articles for a short time, installing, putting in block and measuring automatically two or more device-under-test articles to a measurement on a plane is made. An example is raised to two or less.
Example 1 (in the case of a variant device-under-test article): While an operator actually measures, teach the measurement path of all device-under-test articles by the handicraft, create a measurement program, and pass and perform it to a measurement machine.
Example 2 (in the case of the same-type device-under-test article): When it arranges at a fixed interval to a measurement on a plane and an operator inputs the number of installation and installation interval of a device-under-test article at the time of measurement execution, the method of performing repeatedly only the number of a device-under-test article which installed the measurement program over the device-under-test article simple substance created by a manual operation or off-line teaching is performed.
[0004]
[Problem(s) to be Solved by the Invention] in recent years, we are anxious about the increase which is the time which is in the inclination which the complicated device-under-test article of a configuration and a product increase, and type checking etc. takes in the manufacturing process of a product by demand of the consumer to progress of manufacture technology, such as a machine part, and a product Moreover, in an inspection site, coordinate measurement machines, such as a three dimensional measurer and a works microscope, are spreading.
[0005] The equipment which creates efficiently the measurement program which measures automatically collectively two or more device-under-test articles installed in a measurement on a plane under such a background in order to do the inspection work of a device-under-test article for a short time efficiently for a short time was called for. However, at the listing device of the conventional measurement program, when creating such a measurement program, a device-under-test article is installed in the arrangement same to a measurement on a plane as the time of measurement, and while an operator actually operates a measurement machine, there is only a method of performing measurement instruction. therefore, the trouble that neither the kind of device-under-test article, nor arrangement, the order of measurement, etc. can be flexibly changed to the measurement program which creation of a measurement setup or a measurement program took time, and was once created -- or there was a trouble of occupying a measurement machine at the time of creation of a measurement program
[0006] Moreover, with the off-line teaching equipment using the conventional CAD drawing data, only creation of a measurement program to the device-under-test article of a simple substance can be performed. Therefore, using the measurement program created with this equipment, as a means to measure two or more device-under-test articles collectively, when the device-under-test article of the same configuration was arranged at a fixed interval to a

measurement on a plane and an operator inputted device-under-test number of articles and an installation interval at the time of measurement, the method of repeating and performing a measurement program was taken. However, by this measuring method, since the configuration of a device-under-test article and arrangement which are measured collectively will be restricted, there was a trouble that the device-under-test article of a different configuration could not be measured at once.

[0007] this invention is made in view of the above-mentioned conventional trouble, and aims at offering the measurement programming equipment which can realize the increase in efficiency of inspection business.

[0008]

[Means for Solving the Problem] In order to solve the above-mentioned conventional technical problem, it sets to the listing device of the measurement program of this invention. in invention of a claim 1 A means to generate each measurement arrangement data showing each order of measurement and arrangement of two or more device-under-test articles, It considered as the composition equipped with a means to generate the new measurement program collectively measured from the measurement arrangement data of each measurement program containing each measurement path data of two or more aforementioned device-under-test articles, and each above.

[0009] A means to read each engineering-drawing side data including two or more each configuration information or size information on a device-under-test article in invention of a claim 2, A means to create each drawing-for-inspection side data which added three-dimensions information to the engineering-drawing side data of each above, A means to create each measurement program containing the measurement path data of two or more aforementioned device-under-test articles using the drawing-for-inspection side data of each above, A means to generate each measurement arrangement data showing the order of measurement of two or more aforementioned device-under-test articles, and arrangement using the drawing-for-inspection side data of the measurement program of each above, and each above, It considered as the composition equipped with a means to generate the new measurement program collectively measured from the measurement arrangement data of the measurement program of each above, and each above.

[0010] By invention of a claim 3 The measurement program of each above was combined in the claim 2, and it considered as the composition characterized by creating a new measurement program. invention of a claim 4 -- a claim 2 -- setting -- the above -- it considered as the composition characterized by performing creation of a new measurement program in the state of a measurement machine and off-line

[0011]

[Embodiments of the Invention] Hereafter, this invention is explained, referring to a drawing. Drawing 1 is the block diagram showing the composition of one example of this invention, and is referred to at any time in the following explanation. The measurement programming equipment 3 of this invention is equipped with the drawing receive section 4, the drawing-for-inspection side editorial department 6, I/O control unit 7, an input unit 8, an output unit 9, the measurement information creation section 10, and the measurement information transducer 11.

[0012] The drawing receive section 4 receives the CAD drawing data 2 including the configuration of a device-under-test article created with this CAD equipment 1 from the CAD equipment 1 which designs a device-under-test article. Usually, the CAD drawing data 2 are created in the form of the standard format (IGES) of CAD, and are saved. Moreover, the drawing receive section 4 changes the received CAD drawing data 2 into the drawing-for-inspection side data 5. The drawing-for-inspection side data 5 consist of solidification information 22 grades which position the drawing displayed for the 21 or 2-dimensional configuration information which shows the configuration about the portions (a flat surface, a hole, height, etc.) which serve as the measuring object in a device-under-test article or this device-under-test article in three dimensions, as shown in drawing 2 . The solidification information 22 is setting up a plan on XY flat surface, it setting up a side elevation on YZ flat surface, and displaying the aforementioned system of coordinates to each drawing supposing the three-dimensions system of coordinates of XYZ, and positions the drawing in three-dimensions space.

[0013] The drawing-for-inspection side editorial department 6 performs grant of drawing correction and solidification information 22 grade to the once changed drawing-for-inspection side data 5 as pretreatment of a measurement setup, and edits into the checking drawing-for-inspection side data 5 anew. It connects with the keyboard 16 which an operator operates, and the input unit 8 with which the input device of mouse 17 grade was formed, and I/O control unit 7 can output the directions from an operator inputted into the input unit 8 to the drawing receive section 4, the drawing-for-inspection side editorial department 6, the measurement information creation section 10, and the measurement information transducer 11. An operator gives required directions, checking the display screen of an output unit 9. Moreover, I/O control unit 7 is displayed on the output unit 9 by which the information on the request of the drawing-for-inspection side data 5 (for example, drawing) was prepared in the display 18 and the plotter 19 grade via either the drawing receive section 4, the drawing-for-inspection side editorial department 6, the measurement information creation section 10 or the measurement information transducer 11.

[0014] The measurement information creation section 10 receives instruction of the procedure about configuration measurement of the measuring object from an operator based on the changed drawing-for-inspection side data 5, and creates the measurement program 12 containing the measurement path data which show the procedure of measurement based on the content of instruction. An operator transmits the content of instruction of a measurement procedure through an input unit 8 and I/O control unit 7. The measurement program 12 consists of a parameter 32 which shows the items (a flat surface, a straight line, circle, etc.) set as the object of measurement, a parameter number 31 which shows the turn of measurement, and measurement path (measurement path) 33 grade to which a gauge head moves at the time of measurement, as shown in drawing 3 . Here, the measurement path 33 is defined as sequence of points in the three-dimensions system of coordinates (standard coordinates) set up to drawing-for-inspection side data, and is changed into the sequence of points of the base coordinate system of a measurement machine at the time of measurement.

[0015] measurement of the measuring object [ the measurement information transducer 11 reads the measurement program 12 and the drawing-for-inspection side data 5 which were created, and ] at the time of measurement (device-under-test article) -- the measurement arrangement data 13 including information, such as arrangement on board and turn of measurement, are generated The measurement arrangement data 13 consist of conversion matrix 43 grades which change the coordinate value of the measurement path generated as a coordinate value of the measurement turn number 41 which shows the order of measurement of the device-under-test article to measure, the measurement program name 42, and the standard coordinates which each drawing-for-inspection side has independently into the coordinate value of a certain fixed standard coordinates, as shown in drawing 4 . Moreover, in the measurement information transducer 11, the measurement procedure and measurement path of all the measurement programs 12 which were read are changed from the measurement arrangement data 13, and the new measurement program 12 is generated.

[0016] The generated measurement program 12 is passed to the coordinate measurement machine 15 in the measurement machine interface 14. The coordinate measurement machine 15 measures a device-under-test article in response to this measurement program 12. Operation in this invention of the above composition is explained below. The CAD drawing data 2 inputted from CAD equipment 1 are changed in the drawing receive section 4, and the drawing-for-inspection side data 5 are created. Based on the created drawing-for-inspection side data 5, the measurement program 12 is created in the measurement information creation section 10. The created measurement program 12 is read into the measurement information transducer 11, arrangement of a device-under-test article, turn of measurement, etc. are set up, and the new measurement program 12 is created. Furthermore, in the measurement machine interface 14, the measurement program 12 is passed to the coordinate measurement machine 15, and actual measurement is performed.

[0017] An example of the procedure which creates the measurement program 12 in the measurement information creation section 10 is explained using drawing 5 . In Step s1, an operator sets up arbitrarily the system of coordinates used as the criteria of a measurement path on the drawing which displayed the drawing-for-inspection side data 5. Next, at Step s2, an operator directs the configuration element used as the measuring object on a drawing using a mouse. At the following step s3, an operator sets up the measurement conditions of the number of point of measurement, the measurement direction, etc. required for measurement. The measurement information creation section 10 is Step s4, and registers into the measurement program 12 the measurement path which generated the measurement path according to the aforementioned measurement conditions, is Step s5 and was generated. All the directions methods in this drawing 5 are performed by dialogic operation. By repeating processing of s5 from Step s1, the history information on the measurement data of the device-under-test article of a simple substance is generated on the measurement program 12. That is, measurement path data are generated by creating the operation history of a series of serially in the order which directed measurement. The generated measurement program 12 is saved at a storage. This measurement program 12 creates two or more measurement programs 12 from which it creates for every drawing-for-inspection side or kind of device-under-test article, and a measurement procedure differs to a certain device-under-test article.

[0018] Next, in the measurement information transducer 11, an example of the procedure which creates the new measurement program 12 is explained using drawing 1, drawing 6 , and drawing 7 using two or more measurement programs 12. In the measurement information transducer 11, an operator reads the arbitrary measurement programs 12 into the measurement information transducer 11 out of the measurement program 12 stored in the storage at the drawing 6 step r1. The measurement turn number the read measurement program 12 indicates a measurement program name and the order of measurement of a device-under-test article to be to the order display 71 of measurement of drawing 7 is displayed through an output unit 9. Moreover, at this time, the drawing-for-inspection side data 5 corresponding to the measurement program 12 are also read simultaneously, and are displayed on the device-under-test

article arrangement display 72. The device-under-test article arrangement display 72 displays either the whole company label flat surface of three-dimensions system of coordinates, i.e., XY and YZ, and the ZX sides, and changes it with directions of an operator. Moreover, the device-under-test article arrangement display 72 has the standard coordinates 73 used as the criteria of all device-under-test article arrangement.

[0019] If the measurement program 12 is read into the measurement information transducer 11, a measurement turn number and a measurement program name are displayed on the order display 71 of measurement and the drawing-for-inspection side data 5 are displayed on the device-under-test article arrangement display 72 The measurement information transducer 11 from the position of the drawing-for-inspection side data 5 to the standard coordinates 73 of the device-under-test article arrangement display 72 The conversion matrix 43 (drawing 4) which changes the coordinate value of the standard coordinates of the drawing-for-inspection side data 5 into the coordinate value of the standard coordinates 73 of the device-under-test article arrangement display 72 is generated, and it stores in the measurement arrangement data 13 with the measurement turn number 41 and the measurement program name 42.

[0020] In this way, all the measurement program 12 respectively corresponding to the device-under-test article of a simple substance when it measures is read. The drawing 4 measurement turn number 41 displayed on the order display 71 of the drawing 7 measurement expresses the order of measurement of the device-under-test article at the time of actually measuring. Moreover, when it reads, the drawing data displayed on the device-under-test article arrangement display 72 can also shift and display a position automatically so that it may not lap mutually. Moreover, the measurement path data of the selected measurement program 12 can also be arbitrarily edited by an operator's choosing the drawing-for-inspection side data 5 of the measurement program name of the order display 71 of measurement, or the part arrangement display 72 with a mouse 17, and calling the measurement information creation section 10.

[0021] Next, at the drawing 6 step r2, arrangement of the device-under-test article in the device-under-test article installation field measurement on a plane at the time of measurement is set up to each drawing-for-inspection side data 5 which the measurement information transducer 11 read. A setup of device-under-test article arrangement is performed by changing the display position of the drawing-for-inspection side data 5 displayed on the device-under-test article arrangement display 72. First, an operator directs the drawing-for-inspection side data 5 displayed on the device-under-test article arrangement display 72 with a mouse 17. Next, the position which an operator desires is made to move or rotate the selected drawing-for-inspection side data 5. You may perform this operation by inputting movement magnitude and a rotation by the keyboard 16. Moreover, you may set up by inputting the distance of the standard coordinates of each measurement program 12 and the angle of rotation of an axis of coordinates to the standard coordinates 43 of the device-under-test article arrangement display 42 instead of movement magnitude and a rotation. Change of the display position of inspection data changes automatically the conversion matrix of the corresponding device-under-test article arrangement data 13 according to it. By performing this operation to all the drawing-for-inspection side data 5, the whole device-under-test article arrangement is determined, and the conversion matrix of the measurement arrangement data 13 is changed.

[0022] Next, at Step r3, the order of measurement of device-under-test articles is set up. A setup of the order of measurement is performed when an operator replaces the rank of the measurement program name displayed on the order display 41 of measurement. That is, by an operator's choosing arbitrary program names by the means of mouse 17 grade, and moving up and down out of the measurement program name currently displayed, the rank of a display is changed and the measurement turn number of the measurement arrangement data 13 is automatically changed according to the result.

[0023] However, a setup (Step r2) of device-under-test article arrangement and a setup (Step r3) of the order of measurement can be arbitrarily performed until it ends conversion of the measurement program 12. Finally, at Step r4, the new measurement program 12 is generated based on the measurement arrangement data created in this way. The measurement path of all the measurement programs 12 the measurement path data of the measurement program 12 newly generated were set up from all the measurement path data of the read measurement program 12 have according to the order of measurement of the measurement arrangement data 13 at this time, and read is changed into the coordinate value of the standard coordinates 73 of the device-under-test article arrangement display 72 have, and is stored in a measurement program 12 by the conversion matrix 43 of measurement arrangement data 13. Moreover, in case the measurement program 12 created by doing in this way creates the new measurement program 12, it can also be again read and used for the measurement information transducer 11.

[0024] According to the measurement programming equipment 3 of this example, in the coordinate measurement machine 15, since creation of the measurement program which measures two or more parts collectively can carry out off-line, it does not need to use the coordinate measurement machine 15 at the time of a measurement programming, and can raise the operating ratio of the coordinate measurement machine 15. Moreover, the once created measurement program is freely combinable, and it is lost that the kind of device-under-test article and arrangement are restricted

since arrangement, turn to measure of the device-under-test article measured collectively can be set up and changed by easy operation, it becomes that it is possible in setting up arrangement which uses effectively a device-under-test article installation field measurement on a plane, and very effective measurement can realize.
[0025]
[Effect of the Invention] According to this invention, the efficiency of measurement can be raised as mentioned above from the ability of the device-under-test number of articles measured at once to be made [ many ]. Moreover, since the creation work of this measurement program can be done off-line, it is not necessary to work by the measurement on a plane, and the operating ratio of a measurement machine can be raised.
[0026] Furthermore, when there is a demand of change of the combination of the goods to measure, change of the turn which goods each measures, etc., correcting a measurement program can realize creation of eye a possible hatchet and a measurement program, shortening of the time which correction takes, and improvement in the operating ratio of a measurement machine. Moreover, it becomes possible to set up goods arrangement which uses the part installation field of a measurement machine effectively, and effective measurement support of the ability of the number of goods measured at once to be made [ many ] can be realized.

---

[Translation done.]

* NOTICES *



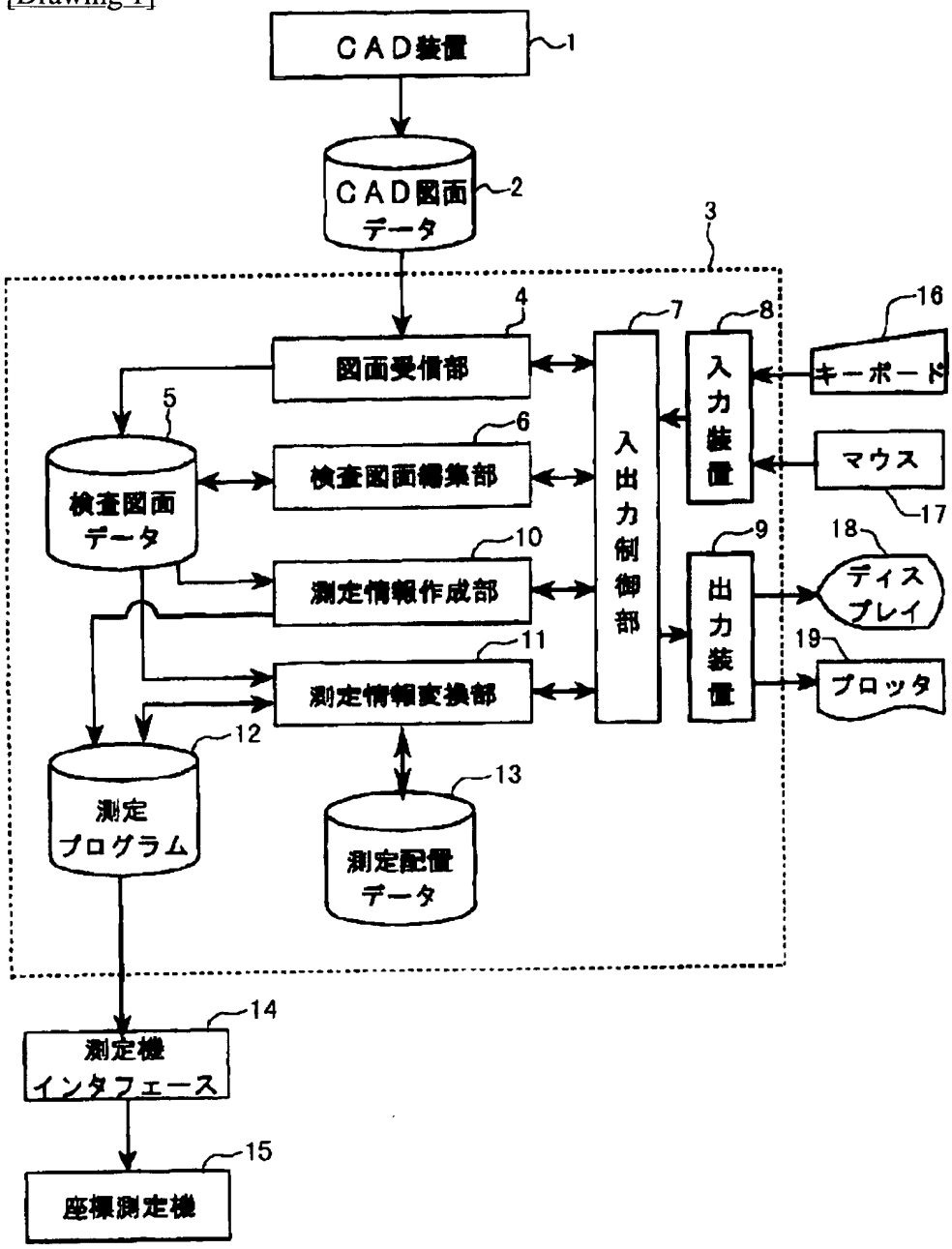
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

---

DRAWINGS

---

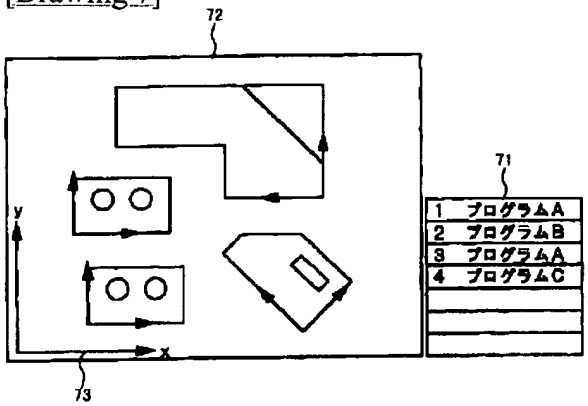
[Drawing 1]



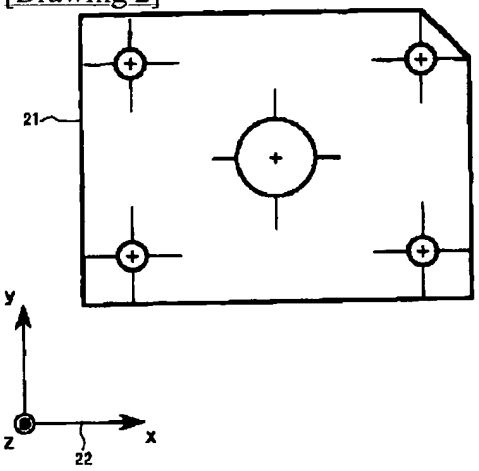

[Drawing 3]

| 31 測定項目番号 | 32 測定項目 | 33 測定パス |
|---|---|---|
| 1 | 平面 | p1,p2,p3 |
| 2 | 直線 | p1,p2 |
| 3 | 円 | p1,p2,p3 |
| | | |

[Drawing 7]




[Drawing 2]

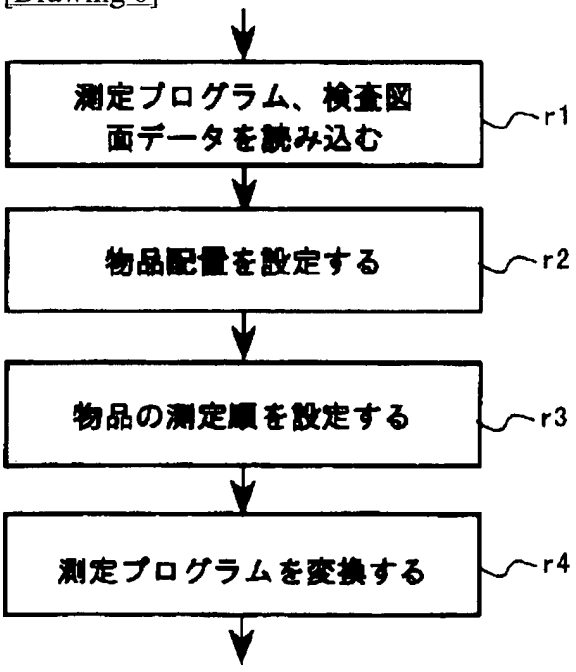



[Drawing 4]

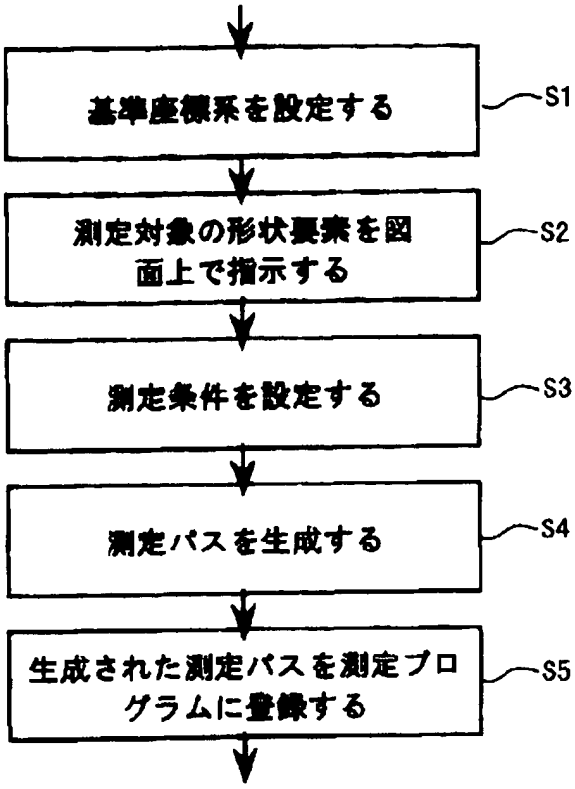
41 42 43

| 測定順番号 | 測定プログラム名 | 変換マトリクス |
|---|---|---|
| 1 | プログラムA | $A=\begin{pmatrix} a_{11}a_{12}a_{13}a_{14} \\ a_{21}a_{22}a_{23}a_{24} \\ a_{31}a_{32}a_{33}a_{34} \\ a_{41}a_{42}a_{43}a_{44} \end{pmatrix}$ |
| 2 | プログラムB | $A=\begin{pmatrix} a_{11}a_{12}a_{13}a_{14} \\ a_{21}a_{22}a_{23}a_{24} \\ a_{31}a_{32}a_{33}a_{34} \\ a_{41}a_{42}a_{43}a_{44} \end{pmatrix}$ |
| 3 | プログラムA | $A=\begin{pmatrix} a_{11}a_{12}a_{13}a_{14} \\ a_{21}a_{22}a_{23}a_{24} \\ a_{31}a_{32}a_{33}a_{34} \\ a_{41}a_{42}a_{43}a_{44} \end{pmatrix}$ |
| 4 | プログラムC | $A=\begin{pmatrix} a_{11}a_{12}a_{13}a_{14} \\ a_{21}a_{22}a_{23}a_{24} \\ a_{31}a_{32}a_{33}a_{34} \\ a_{41}a_{42}a_{43}a_{44} \end{pmatrix}$ |
| | | |

[Drawing 6]




[Drawing 5]




---

[Translation done.]